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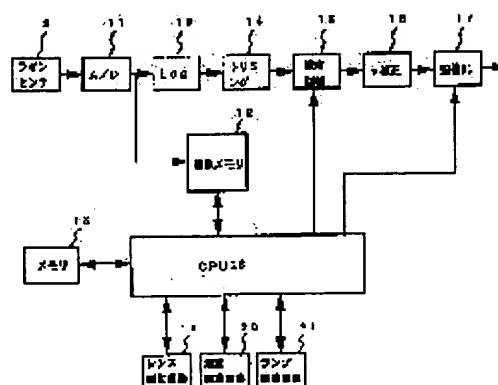
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(54) IMAGE READER

(57)Abstract:

PURPOSE: To attain reproduction of an image at optimum density at all times by conducting density control based on background density when an original is a character image and based on height information when the original is an intermediate tone image.

CONSTITUTION: A line sensor 8 conducts preliminary scanning to sample image data for height detection and density control of an original and an image memory 12 stores data by several lines each. A CPU 23 reads one by one line of the image data stored in the image memory 12 to detect a height of the original face at each read position and to detect a luminance level of image data corresponding to an image part and a background part of each line respectively and stores them to a memory 18. Then whether an image is a character image or an intermediate tone image is set by the entry by the operator and the system for image density control for the main scanning is selected based on the entry. That is, in the case of the character image, the density level is adjusted based on the background density of an original and in the case of the intermediate tone image, the density level is adjusted based on the height information of the original.



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CLAIMS

[Claim(s)]

[Claim 1] The picture reader characterized by providing the following. An image pick-up means to read a manuscript. A storage means to store temporarily the image data of the manuscript picturized by the aforementioned image pick-up means. A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the aforementioned storage means. When judged with a manuscript picture being a character picture by height detection means to detect the height information on a manuscript, judgment means to judge the kind of manuscript picture, and the aforementioned judgment means When concentration level of image data is adjusted based on the natural complexion concentration of the manuscript detected by the aforementioned concentration detection means and it is judged with a manuscript picture being a halftone picture by the aforementioned judgment means Concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the aforementioned height detection means.

[Claim 2] The picture reader characterized by providing the following. An image pick-up means to read a manuscript. A storage means to store temporarily the image data of the manuscript picturized by the aforementioned image pick-up means. A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the aforementioned storage means. When judged with a manuscript side being flat by height detection means to detect the height information on a manuscript, judgment means to judge the configuration of a manuscript side, and the aforementioned judgment means When judged with adjusting concentration level of image data based on the natural complexion concentration of the manuscript detected by the aforementioned concentration detection means, and a manuscript side curving by the aforementioned judgment means Concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the aforementioned height detection means.

[Claim 3] The picture reader characterized by providing the following. An image pick-up means to read a manuscript. A storage means to store temporarily the image data of the manuscript picturized by the aforementioned image pick-up means. A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the aforementioned storage means. A noise level detection means to detect the noise level contained in the data of the height information detected by height detection means to detect the height information on a manuscript, and the natural complexion concentration and the aforementioned height detection means which were detected by the aforementioned concentration detection means, When each noise level detected by the aforementioned noise level detection means is in tolerance Concentration level of image data is adjusted based on the natural complexion concentration of the manuscript detected by the aforementioned concentration detection means. Concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the aforementioned height detection means when the noise level of the natural complexion concentration detected by the aforementioned noise level detection means exceeds tolerance.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the reader which reads a book manuscript etc. in more detail about a picture reader.

[0002]

[Description of the Prior Art] There are some which adjusted the concentration of a reading picture by carrying out feedback control of the voltage of the lamp which illuminates a manuscript so that a sensor may detect the amount of reflected lights from a manuscript during reading operation and the output may become fixed in a picture reader conventionally. Moreover, in the equipment which performs digital processing of image data, there are some which adjust picture concentration on image data according to the value which carried out the monitor of the amount of reflected lights of a manuscript, and carried out the monitor. By the way, generally the manuscripts read differ in the concentration of the natural complexion section, or the concentration of the picture section greatly according to the kind. For example, with a newspaper or the stale book, since the form itself has yellowed, the concentration of natural complexion becomes high. Moreover, with the documents written with the pencil or the color pen, the concentration of the character which is a picture becomes low. Furthermore, what was copied with the diazo formula copying machine has both property of these. Thus, there is equipment which obtained suitable picture quality by creating the histogram which shows a manuscript concentration distribution to change of the concentration contrast produced with the property of a manuscript, distinguishing the kind of manuscript based on it, and performing concentration control according to it (for example, refer to JP,5-328129,A).

[0003]

[Problem(s) to be Solved by the Invention] However, such conventionally, in equipment, although adjustment of the optimal picture concentration is performed in the manuscript of a character picture with which a character serves as a subject since concentration control is always performed by the fixed method for example, optimal concentration adjustment is not performed in the manuscript of halftone pictures, such as a photograph. Furthermore, in the camera type reader which reads a manuscript in the upper part, when reading manuscripts, such as books and a file, the concentration of the read picture changes greatly with the bouncing motion of the manuscript side resulting from the curve of a manuscript side, change of the inclination of a manuscript side, reflection factors of a manuscript side, etc. That is, since the lighting lamp of equipment is illuminating the manuscript from the upper part, if a manuscript is expensive, a manuscript side will become close to a lighting lamp, and it will become close also to a reading sensor, and the light income of a sensor will become large. Thus, if the light income of a sensor changes with the curves of a manuscript side, the picture concentration reproduced within the same manuscript differs, and it is not desirable.

[0004] this invention is made in view of such a situation, and aims at offering the picture reader which solved unarranging [that the picture concentration reproduced within the same manuscript which was mentioned above differed]. Moreover, this invention is not influenced by the kind (are they a character picture or a halftone picture?) of picture of a manuscript, but aims at offering the picture reader which can perform always optimal concentration control. Furthermore, this invention is not influenced by the kind (are they a book manuscript or a sheet-like manuscript?) of manuscript, but aims at offering the picture reader which can perform always optimal concentration control. this invention is not influenced by the noise but aims at offering the picture reader which can perform always optimal concentration control further again.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the picture reader of invention of a

claim 1 An image pck-up means to read a manuscript, and a storage means to store temporarily the image data of the manuscript picturized by the image pck-up means, A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the storage means, When judged with a manuscript picture being a character picture by height detection means to detect the height information on a manuscript, judgment means to judge the kind of manuscript picture, and the judgment means When concentration level of image data is adjusted based on the natural complexion concentration of the manuscript detected by the concentration detection means and it is judged with a manuscript picture being a halftone picture by the judgment means It has the concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the height detection means. A proper concentration control system is chosen by whether a manuscript picture is a character picture or they are halftone pictures, such as a photograph, in the above-mentioned composition.

[0006] Moreover, the picture reader of invention of a claim 2 An image pck-up means to read a manuscript, and a storage means to store temporarily the image data of the manuscript picturized by the image pck-up means, A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the storage means, When judged with a manuscript side being flat by height detection means to detect the height information on a manuscript, judgment means to judge the configuration of a manuscript side, and the judgment means When judged with adjusting concentration level of image data based on the natural complexion concentration of the manuscript detected by the concentration detection means, and a manuscript side curving by the judgment means It has the concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the height detection means. A proper concentration control system is chosen [which is the curved thing and adjusts ***** level with dirt] by whether a manuscript side is flat or it curves in the above-mentioned composition.

[0007] Moreover, the picture reader of invention of a claim 3 An image pck-up means to read a manuscript, and a storage means to store temporarily the image data of the manuscript picturized by the image pck-up means, A concentration detection means to detect the concentration of the natural complexion section of a manuscript from the image data memorized for the storage means, A noise level detection means to detect the noise level contained in the data of the height information detected by height detection means to detect the height information on a manuscript, and the natural complexion concentration and the height detection means which were detected by the concentration detection means, When each noise level detected by the noise level detection means is in tolerance Concentration level of image data is adjusted based on the natural complexion concentration of the manuscript detected by the concentration detection means. When the noise level of the natural complexion concentration detected by the noise level detection means exceeds tolerance, it has the concentration control means which adjust concentration level of image data based on the height information on the manuscript detected by the height detection means. In the above-mentioned composition, if concentration level of image data was adjusted based on the natural complexion concentration of a manuscript when noise level was in tolerance, and the noise level of natural complexion concentration is over tolerance, concentration level of image data will be adjusted based on the height information on a manuscript.

[0008]

[Embodiments of the Invention]

(The 1st example) The 1st example of this invention is explained with reference to a drawing. Drawing 1 is the perspective diagram showing the whole picture reader 1 composition to which this invention was applied, and drawing 2 is the perspective diagram showing signs that books were laid as a manuscript to read. The picture reader 1 has the manuscript base 2, and when reading the manuscript (such a manuscript is hereafter called a book manuscript.) which is two or more pages by which unilateral edges, such as books and a file, were filed, where the page of the request to read is opened wide, it lays it in the manuscript base 2 upward. The photography camera section 3 which reads a manuscript by optical scan above the manuscript base 2 is formed. Between the manuscript base 2 and the photography camera section 3, a predetermined interval is given and a workspace is formed of this interval. Moreover, the lighting section 4 which is arranged in the back side upper part of the manuscript base 2, and illuminates a manuscript to the picture reader 1, The mirror 6 which copies the side by the side of the back of the control panel 5 which sets up picture reading conditions etc., and the manuscript which has been arranged along the manuscript base 2 at the back side of the manuscript base 2, and was laid in the manuscript base 2, Similarly it is arranged at the back side of the manuscript base 2, and orientation plate 6A used as the positioning criteria of a manuscript and the control section shown in drawing 8 are prepared. The image data photoed by the image pck-up

camera section 3 is outputted to desired output units (a printer, computer, etc.) by the control section in response to various processings.

[0009] Here, the name of each part of the book manuscript 10 laid on the manuscript base 2 is defined. It is both the page whole region of right and left of the book manuscript 10 opened wide, and the field read by the photography camera section 3 is called manuscript side 10a, and the side edge by the side of the back of the cover of up edge 10b and the book manuscript 10 is called up edge 10c of a cover for the side edge of manuscript side 10a by the side of the back of the laid book manuscript 10.

[0010] Drawing 3 and drawing 4 are drawings which looked at the picture reader 1 from a transverse plane and the side. The photography camera section 3 is equipped with the CCD line sensor 8 which arranged two or more image pck-up elements from the near side of the picture reader 1 in the shape of a line to the back side (main scanning direction), and the taking lens 7 which carries out image formation of the manuscript picture laid in the manuscript base 2 on a line sensor 8. It is moved in the direction of vertical scanning (direction shown by the arrow S of drawing 3) in which main scanning direction and a manuscript picture cross at right angles in the image formation side by which image formation is carried out, and a line sensor 8 reads a picture for every line in each reading position of the direction of vertical scanning. Moreover, the taking lens 7 is formed in the direction of an optical axis by the lens drive circuit possible [movement], and it is moved according to the height of the manuscript obtained by the height detection mentioned later, and it always carries out image formation of the image of manuscript side 10a in the state of a focus on a line sensor 8.

[0011] The book manuscript 10 is pressing up edge 10c of a cover against orientation plate 6A, and laying it on the manuscript base 2, makes up edge 10c of a cover in agreement with a criteria position, and is positioned. namely, the grade by which orientation plate 6A is equivalent to the thickness of the cover of the book manuscript 10 from the manuscript installation side of the manuscript base 2 -- projecting -- **** -- this protrusion -- the bottom, cover up edge 10c of the book manuscript 10 is pressed, orientation plate 6A is made in agreement with the center line of the manuscript base 2, and a part for the center section of a manuscript is laid in it A mirror 6 is extended in the direction of vertical scanning by the back side of the manuscript base 2, to the manuscript installation side of the manuscript base 2, inclines, and is installed at the angle of 45 degrees, and the side of the book manuscript 10 laid in the manuscript base 2 is copied. The profile of the book manuscript 10 copied by the mirror 6 is projected with a lens 7 with manuscript side 10a. The line sensor 8 has sufficient length which reads the image of projected manuscript side 10a and the side, and reads simultaneously the image of manuscript side 10a and the side by scanning movement. In addition, although this example showed what used the line sensor, it may replace with this and an area sensor may be used.

[0012] Next, the control circuit of this example is explained. Drawing 8 is the block diagram of the control circuit of this picture reader 1. In this example, a line sensor 8 performs the reserve scan for sampling image data for height detection of the manuscript side which takes the initiative in scanning operation (this scanning operation) of actual picture reading, and is mentioned later, and concentration control. Image formation of the reflected light from the manuscript 10 collected by the taking lens 7 is carried out on a line sensor 8, and it is changed into the electrical signal according to the light income, and is outputted to A/D converter 11 by the image pck-up element of a line sensor 8 in order of the array of an image pck-up element. The electrical signal inputted into A/D converter 11 is changed into digital image data, and is outputted to an image memory 12 through the Log conversion circuit 13 in the trimming circuit 14 at the time of this scan at the time of a reserve scan. An image memory 12 has the capacity which memorizes the image data inputted by several lines, and memorizes the image data of every several lines obtained with the reserve scan one by one.

[0013] Since the image data outputted from A/D converter 11 shows the level according to the light income of the image pck-up element of a line sensor, i.e., the intensity level on a manuscript side, it changes this into the concentration level of a picture by the Log conversion circuit 13. Conversion of the Log conversion circuit 13 is performed by the following formula.

$D = \log 1/L$ However, D:concentration value, L: Brightness value [0014] Since the image data inputted as explained previously is a thing also containing the image data of the side of the book manuscript 10, the trimming circuit 14 deletes the image data of the side, extracts only the image data of manuscript side 10a, and outputs it to the concentration control circuit 15.

[0015] The concentration control circuit 15 adjusts picture concentration level by processing of the concentration control mentioned later. The image data which had concentration level adjusted is outputted to external devices, such as a printer and a personal computer, in response to gamma amendment and a distorted amendment in a gamma

correction circuit 16 and the distorted amendment circuit 17. since a picture is distorted with the curve of manuscript side 10a with a distorted amendment here in the case of the book manuscript 10 -- this -- an amendment -- things are pointed out In addition, about gamma amendment, it mentions later.

[0016] Among drawing, CPU23 is a microcomputer and manages the motion control of a reader. CPU23 detects the intensity level of the image data equivalent to the intensity level of the image data equivalent to the picture section of each line, and the natural complexion section of a manuscript side, and stores it in memory 18 while it reads serially the image data of every one line memorized by the image memory 12 and detects the height of manuscript side 10a of each reading position based on this image data. Moreover, at the time of this scan, CPU23 gives the height data or concentration level data memorized by memory 17 to the concentration control circuit 15, and controls concentration level adjustment of the image data performed by the concentration control circuit 15. CPU23 outputs a control signal to the lens drive circuit 19, moves a lens according to the reading position of a line sensor 8, and, furthermore, the picture of manuscript side 10a is always made to carry out image formation in the state of a focus on a line sensor 8. Moreover, CPU23 outputs a control signal to the scanning drive circuit 20 and the lamp drive circuit 21, and controls scanning movement of a line sensor, and lighting of the lamp of the lighting section 4.

[0017] Next, height detection of a manuscript side is explained. If it lays on the manuscript base 2 upward where the book manuscript 10 is opened wide, each page of the right and left which are manuscript side 10a will become the configuration which curved spatially. For this reason, since the distance of a line sensor 8 and manuscript side 10a of the book manuscript 10 is changed according to each reading position of the direction of vertical scanning, there is amendment need about focus adjustment of the lens 7 in each reading position, and the read distortion of a picture. In this reader 1, the height from the manuscript base 2 of manuscript side 10a of the book manuscript 10 is detected in each reading position, and focus adjustment and a distorted amendment are performed based on this detection result.

[0018] Drawing 5 is drawing showing the principle of height detection processing used with the picture reader 1. By laying the book manuscript 10 in a predetermined position, 10d of profile of the book manuscript 10 is copied by the mirror 6. It asks for the distribution of manuscript height by reading 10d of this profile by the line sensor 8. In addition, in drawing 5, an alternate long and short dash line A shows the reading range of a line sensor 8, and 1 - n show the address of the image pck-up element of a line sensor 8 in order of the space Z twist.

[0019] Drawing 6 shows the situation of the image data read by the photography camera section 3 which has the above-mentioned composition. In this drawing, the image of a background with which the image of manuscript side 10a and b were reflected to the image of the manuscript base 1, and c was reflected to the mirror 6 by a, the profile (10d) of the book manuscript 10 with which d was reflected to the mirror 6, and e show the image of orientation plate 6A, and f shows the alignment criteria position of a manuscript. The image a of a manuscript side and the image d of the manuscript side are read by height change of a manuscript as it curved to main scanning direction. Generally, since it is near paper white, a manuscript side and the manuscript side are read white. To it, the amount of reflected lights of the image c of a background reflected to the manuscript base 2 currently colored more deeply than manuscript natural complexion, orientation plate 6A, and a mirror 6 decreases, and it is read black. Moreover, in main scanning direction, the image a of a manuscript side and the image d of the side are distinguishable because the image e of orientation plate 6A intervenes between the image a of a manuscript side, and the image d of the manuscript side reflected to the mirror 6.

[0020] Drawing 7 shows the situation of the output for the main scanning direction of one line read by the line sensor 8. This example shows the case where the picture of the position shown by the dotted line is read by the line sensor 8, in drawing 6. The address of the image pck-up element of a line sensor 8 is taken along the horizontal axis, and the output (concentration of an image) of each image pck-up element is taken along the vertical axis. In the image d of the manuscript side with which the image c of a background with which (1) was reflected on the mirror 6 among drawing, and (2) were reflected on the mirror 6, and (3), the image e of the front face of orientation plate 6A and (4) show the image a of manuscript side 10a, and (5) shows the field on the image pck-up element of each image of the image b of a manuscript base. Dth is a predetermined threshold for distinguishing the image or other images of a manuscript. n1 is the minimum address value of the image pck-up element of the output exceeding Threshold Dth, i.e., the value which shows the position where image formation of the up edge 10b of the manuscript side in 10d of images of the manuscript side is carried out. n2 is the minimum address value in the image pck-up element which reads the image of orientation plate 6A, and is the value of fixation. It is the number of pixels equivalent to the height of the manuscript used by height detection, and (n2-n1) is interlocked with the height of manuscript side 10a, and it is changed.

[0021] If a line sensor 8 carries out scanning movement in the direction of vertical scanning, according to the height

of the manuscript side in each position of the direction of vertical scanning, the value of $n1$ can change and, thereby, the height data ($n2-n1$) which are the number of pixels equivalent to the height of a manuscript side in each position of the direction of vertical scanning can be obtained. By reading this height data and breaking by resolution, manuscript side height (distance from the manuscript installation side of the manuscript base 2 to manuscript side 10a) can be found. Specifically, CPU23 reads the image data which was obtained with the reserve scan and memorized by the image memory 12 per line one by one, and obtains $n1$ for the concentration level of the image data of each pixel for every line as compared with Threshold Dth. In this way, ** ***** data are stored in memory 18.

[0022] Next, picture concentration control is explained. In the picture reader 1, concentration control which adjusts concentration level of the read image data is performed according to the level of the concentration of the picture portion of manuscript side 10a, and the concentration of a natural complexion portion. In concentration control, the method of picture concentration control is changed by whether they are halftone pictures, such as a character picture to which the picture of manuscript side 10a makes a character a subject, or a photograph. Whether it is a character picture or it is a halftone picture perform concentration control of the 2nd method based on the height of the manuscript side detected by the height detection explained previously, when concentration control of the 1st method is performed based on the image data read with the reserve scan when it was set up by the input of the operator from a control panel 5 and a character picture was set up and a halftone picture is set up.

[0023] First, picture concentration control of the 1st method is explained. Drawing 9 is drawing explaining change of the light income of the line sensor 8 by the curve of the book manuscript 10. The book manuscript 10 laid on the manuscript base 2 constitutes the configuration from which the binding section serves as a valley and the center section of both the pages generally serves as a mountain. Here, supposing gloss is high and manuscript side 10a is close to a mirror plane, the light which it was emitted from the lighting section 4 and irradiated by manuscript side 10a will be reflected regularly by the manuscript side 10a, and, at both ends, will go to the outside of this equipment 1 toward the center of the picture reader 1 in the binding section. Since the photography camera section 3 is in the central upper part of this equipment 1, there is much light income of a line sensor 8 in the binding section of a manuscript, and, at both ends, it decreases. Although this phenomenon is not produced with a manuscript with the high degree of diffusion by which the light which carried out incidence to the manuscript is reflected in all directions uniformly, since some also have glossiness, the difference of the light income by the configuration generates the manuscript with which the picture was drawn on space, such as books and a file.

[0024] Drawing 10 is a histogram which shows the distribution of the intensity level of the image data for one line. A horizontal axis shows the intensity level of image data among drawing, and a vertical axis shows the number of pixels of each intensity level (frequency). In the manuscript of a character picture, luminance distribution constitutes the shape of a normal distribution which has a peak in the intensity level corresponding to the character section, and the intensity level corresponding to the natural complexion section. Therefore, the intensity level of the character section (picture section) and the natural complexion section of a manuscript is detectable based on this distribution. In this example, the brightness of the character section has one half of the frequency of the peak value in low intensity-level LC and the luminance distribution of the natural complexion section most among distributions, from the intensity level of a peak, detects the low intensity level LB and makes each a character section intensity level and a natural complexion section intensity level. CPU23 reads the image data which was obtained with the reserve scan and memorized by the image memory 12 per line one by one, and processing of detection of this intensity level detects intensity levels LC and LB for every line, changes them into the concentration level DC and DB, and is memorized in memory 18. Conversion on concentration level from an intensity level is performed based on the transformation explained by the previous Log conversion circuit 13.

[0025] Drawing 11 shows the relation between intensity-level LB of the natural complexion portion of the detected manuscript, intensity-level LC of a picture portion, and the height distribution of the manuscript side acquired by the height detection mentioned above. according to the phenomenon previously explained using drawing 9, it interlocks, change of height level is resembled, and it turns out that the intensity levels LB and LC of the natural complexion portion of a manuscript and a picture portion are changed Each intensity level in the reading positions X1 and X2 is shown as LB1, LB2, LC1, and LC2 (it mentions later for details). In this way, with a reserve scan, if the character section concentration level DC in each reading position and the natural complexion section concentration level DB are memorized by memory 18, at the time of this scan, CPU23 will read such concentration level and will give it serially to the concentration control circuit 15 from memory 18. The concentration control circuit 15 performs concentration adjustment of image data according to such concentration level.

[0026] Drawing 12 is drawing for explaining concentration adjustment of the image data performed by the

concentration control circuit 15. The primary function used for the concentration adjustment performed by the 2nd ***** and the concentration control circuit 15 is shown among drawing. The 2nd ***** bucket ***** shows the concentration level of the image data inputted into the concentration control circuit 15, and the horizontal axis shows the concentration level after concentration adjustment, i.e., the concentration level of the image data outputted from the concentration control circuit 15. the 1st -- it ***** therefore mentions later

[0027] The concentration control circuit 15 uses natural complexion section concentration level DB as an intercept, based on the character section concentration level DC given from CPU23, and the natural complexion section concentration level DB, it sets up a primary function so that the character section concentration level DC may turn into the maximum concentration level, and it changes and outputs the image data inputted from the trimming circuit 14 by this set-up linear function. Therefore, the natural complexion portion of manuscript side 10a is outputted by this concentration adjustment as white (concentration 0) image data, and the character section is outputted as black (the maximum concentration level) image data.

[0028] Specifically, as shown in drawing 11, supposing it is the reading positions X1 and X2 and detects the intensity levels LB1 and LB2 of a natural complexion portion, and the intensity levels LC1 and LC2 of a picture portion, respectively, the values DB1 and DC1 and DB2 which changed these intensity levels LB1, LC1, LB2, and LC2 into concentration level, and DC2 will be given to the concentration control circuit 15. As shown in drawing 12, the concentration control circuit 15 is the primary function which was obtained with this scan and with which it reads, and level DB1 is used as an intercept, and level DC 1 turns into the maximum concentration level in the image data of a position X1, and the image data of the reading position X2 uses level DB2 as an intercept, and it changes it with a primary function with which level DC 2 turns into the maximum concentration level.

[0029] Like a newspaper, even if a manuscript side is the manuscript which has the natural complexion of a gray, the image data of a natural complexion portion will be changed into a white level, and will be reproduced by the natural complexion of a print form on a print picture by the above processing. moreover, change of the brightness by the curve of manuscript side 10a of the book manuscript 10 since the above-mentioned picture concentration adjustment was performed in each reading position of the direction of vertical scanning, as the natural complexion of manuscript side 10a was unified into the white level in each reading position and showed by drawing 9 -- an amendment -- things are made

[0030] The 1st ***** of drawing 12 and the situation of concentration conversion of the image data used for gamma amendment performed by the gamma correction circuit 16 are shown. The 1st ***** bucket ***** shows the concentration level of the image data inputted into a gamma correction circuit 16, i.e., the concentration level of the image data outputted from the concentration control circuit 15, and the vertical axis shows the concentration level after gamma amendment, i.e., the level of the image data outputted from a gamma correction circuit 16. In gamma amendment, nonlinear conversion is performed according to the property of the printer of an output place etc. In this example, in order to stand the inclination of the transform function in a low concentration region in order to improve the repeatability of a thin character, and to improve the repeatability of a photograph, the inclination of output concentration is made loose in the middle concentration region. (1-4-2) Picture concentration control of the 2nd method [0031] Next, picture concentration control of the 2nd method is explained. In picture concentration control of the 1st method mentioned above, although it is suitable in the character picture which can detect the concentration of the natural complexion portion of a manuscript, the manuscript whole surface is a picture like a photograph, and it is unsuitable for what cannot read the natural complexion of a manuscript. Therefore, in this example, when a halftone picture is set up by the input of the operator from a control panel 5, picture concentration control of the 2nd method described below is carried out.

[0032] As shown in drawing 11, the intensity level of the natural complexion portion of a manuscript and a picture portion is changed like change of height level according to the phenomenon previously explained using drawing 9. In the photograph, from intensity-level LB of a natural complexion portion and intensity-level LC of a picture portion being undetectable, beforehand, it assumes that it is that whose manuscript is a sheet-like thing, and the concentration level when reading the space laid on the manuscript base 2 is memorized in memory 18. Moreover, the concentration level when reading similarly the black picture drawn on space is also memorized in memory 18, and the concentration level DC and DB is computed based on such concentration level according to bouncing motion. By CPU23, this calculation is performed in each reading position of the direction of vertical scanning, and is memorized in memory 18. Subsequent processing is the same as concentration control of the 1st previous method. That is, at the time of this scan, from memory 18, CPU23 reads such concentration level and gives it serially to the concentration control circuit 15. The concentration control circuit 15 performs concentration adjustment of image data according to such

concentration level.

[0033] Next, a control procedure is explained. Drawing 13 is a flow chart which shows the procedure of the control performed by CPU23. the character picture to which the picture of manuscript side 10a makes a character a subject here -- or the method of concentration control by halftone pictures, such as a photograph, is changed

[0034] If the start of reading operation of the manuscript reader 1 is directed by the depression of an operator's start button (it is YES at S11), CPU23 outputs a control signal to the lamp drive circuit 21, will turn on the lamp of the lighting section 4, and will illuminate a manuscript 10 (S12), next will output a control signal to the scanning drive circuit 20, will move a line sensor 8, and will perform reserve scan operation (S13). Thereby, the image data of every several lines is memorized one by one by the image memory 12. Next, when it distinguishes whether the character picture from a control unit 5 is specified, or the halftone picture is specified (S14) and the photograph manuscript is chosen, the luminance distribution of a manuscript is checked and it distinguishes whether the manuscript actually put on the manuscript base 2 is a character picture, or it is a halftone picture from the image data in the image memory 12 obtained with the reserve scan (S15). Distinction here creates the histogram which shows the distribution of the number of pixels for every intensity level as shown in drawing 10, when two peaks appear, it considers as a character picture, and it judges with it being a halftone picture in other cases. When judged with it being a halftone picture as a result of a judgment, concentration control of the 2nd method of the above is set up (S16), height detection mentioned above from the image data memorized by the image memory 12 with a reserve scan is performed, and the detected height data are memorized in memory 18. After a reserve scan is completed, this scanning operation is performed and concentration adjustment of image data is performed by automatic concentration control of the 2nd method (S17).

[0035] When judged with on the other hand it being a character picture in the judgment of S14 or S15, concentration control of the 1st method explained previously is set up (S18), and while performing height detection mentioned above from the image data memorized by the image memory 12 with a reserve scan, an intensity level is remembered to be height data which detected the intensity level of the natural complexion section and the picture section, and were detected in memory 18. After a reserve scan is completed, this scanning operation is performed and concentration adjustment of image data is performed by automatic concentration control of the 1st method (S17).

[0036] (The 2nd example) the character picture to which a picture makes a character a subject in the 1st example explained previously -- or although what changes the method of concentration control by halftone pictures, such as a photograph, was shown, in the 2nd example described below, the manuscript to read changes with the manuscript of the shape of a sheet with uniform book manuscript or height That is, since the height of the image data resulting from the curve of a manuscript side is detected and there is amendment need about this in the distorted amendment circuit 17 when a manuscript is a book manuscript, height detection is indispensable. Therefore, picture concentration is adjusted by concentration control of the 2nd method using this height data. Moreover, in a sheet-like manuscript, since it is not necessary to ask for the distribution of height, concentration control of the 1st method performs concentration adjustment of image data. Thereby, it becomes unnecessary in the case of a book manuscript detecting [of the brightness data of the picture section with a reserve scan and the natural complexion section], in the case of a sheet-like manuscript, detection of height becomes unnecessary and improvement in the speed of processing can be attained.

[0037] Drawing 14 is a flow chart which shows the procedure of the control performed in CPU23 in this 2nd example. In addition, in this example, since it is the same composition as the 1st example previously explained except for the point constituted so that the manuscript which an operator reads from a control panel 5 about composition may input whether it is a book manuscript or it is a sheet-like manuscript, it omits about explanation of the composition.

[0038] In drawing 14, processing of S1-S3 is the same as processing of drawing 13 of S11-S13. When it distinguishes whether the book manuscript from a control unit 5 is specified, or the sheet-like manuscript is specified and (S4) and the book manuscript are chosen, a height distribution of a manuscript is checked and it distinguishes whether the manuscript actually put on the manuscript base 2 is a book manuscript, or it is a sheet-like manuscript from the image data in the image memory 12 obtained with a reserve scan (S5). When it judges with it being a book manuscript as a result of a judgment, the 2nd concentration control explained previously is set up (S6), height detection mentioned above from the image data memorized by the image memory 12 with a reserve scan is performed, and the height data detected in memory 18 are memorized. After a reserve scan is completed, this scanning operation is performed and concentration adjustment of image data is performed by automatic concentration control of the 2nd method (S7).

[0039] When it distinguishes that it is a sheet-like manuscript in S4 or the judgment of S5 on the other hand, concentration control of the 1st method explained previously is set up (S8), and while performing height detection

mentioned above from the image data memorized by the image memory 12 with a reserve scan, an intensity level is remembered to be height data which detected the intensity level of the natural complexion section and the picture section, and were detected in memory 18. After a reserve scan is completed, this scanning operation is performed and concentration adjustment of image data is performed by automatic concentration control of the 1st method (S7).

[0040] (The 3rd example) the character picture to which a picture makes a character a subject in the 1st example explained previously -- or what changes the method of concentration control by halftone pictures, such as a photograph, was shown. Moreover, in the 2nd example, what the manuscript to read changes with the manuscript of the shape of a sheet with uniform book manuscript or height was shown. On the other hand, in the 3rd example described below, concentration control of the 1st method is given priority to and performed, and when the noise component is contained in the detected intensity levels LB and LC which are used for concentration control of the 1st method more than tolerance, concentration adjustment by concentration control of the 2nd method is performed.

[0041] Drawing 15 is a flow chart which shows the procedure of the control performed in CPU23 in this 3rd example. In addition, in this example, if the control procedure shown in drawing 15 is removed, since its composition is the same as the 1st example, it omits about explanation of composition.

[0042] In drawing 15, processing of S21-S23 is the same as processing of drawing 13 of S11-S13. It judges whether the image data of every one line memorized by the image memory 12 obtained with a reserve scan is read, intensity-level LB of the natural complexion section in the reading position of each vertical-scanning direction and intensity-level LC of the picture section are detected, and there is any discontinuous portion in the distribution of each intensity level (S24). It judges with a judgment here being a discontinuous portion, i.e., the data containing the noise, when the difference which computed the difference of the intensity level of order and was computed exceeds a predetermined value. When there is a discontinuous portion (i.e., when the noise is contained in the detected intensity level), it judges whether there is any discontinuous portion in a height distribution by checking a height distribution of a manuscript from the image data in an image memory 12 similarly (S25). Also in a height distribution, a discontinuous portion exists, and an alarm display is performed noting that execution of concentration control is impossible, if it judges with the noise being contained also in height detection (S26). On the other hand, when there is no discontinuous portion in an intensity level (S24YES), concentration control of the 1st method explained previously is set up (S29), this scanning operation is performed, and concentration adjustment of image data is performed by automatic concentration control of the 1st method (S28). Moreover, when there is no discontinuous portion in a height distribution (S25 YES), concentration control of the 2nd method explained previously is set up (S27), this scanning operation is performed, and concentration adjustment of image data is performed by 2nd automatic concentration control (S28). Thereby, in the 3rd example, concentration adjustment of the optimal image data which does not receive influence in a noise is attained.

[0043] (Modification) In concentration control of the 1st method mentioned above, in each reading position of the direction of vertical scanning, although the concentration level DB of the natural complexion section and the concentration level DC of the picture section were set up and concentration adjustment was performed, it is good also as a value of fixation of the concentration level DC. That is, when a character is made into a subject and the pixel corresponding to a character portion does not exist in the manuscript of a character picture depending on a reading position, there is a case of being very few and the intensity level of the picture section may be unable to be detected. Therefore, it fixes to the value DC of fixation of the concentration level DC of the character section, only the concentration level DB of the natural complexion section is detected, and you may make it give the concentration control circuit 15, as shown in drawing 16.

[0044] Moreover, in the 3rd example, although what changes a concentration control system by the existence of a noise was shown, a noise is detected and it is good in this as for a method of an amendment by processing of CPU24. Drawing 17 shows the state where the intensity level in the direction of vertical scanning of a manuscript side is discontinuity (a dashed line shows) under the influence of a noise etc., and, in such a case, removes and amends a noise. For example, when the character is not written to the manuscript side depending on the reading position, or when it covers the whole surface and there is a pattern, these data streams may become discontinuous. In such a case, CPU23 performs processing which removes and smooths a discontinuous portion. Specifically, using the continuity of data, the data which are separated from the data value of order more than fixed are removed, and use the average of order data instead. However, in the binding section of a manuscript, since the height of a manuscript changes discontinuously, possibility that an intensity level will also become discontinuous is high. Equalization processing is not performed in such a place. Concentration adjustment of image data is performed by the concentration control circuit 15 using the intensity level which the above-mentioned processing ended at the time of this scanning

operation.

[0045] Moreover, since it turns out that the height distribution of an intensity level and a manuscript side has fixed correlation as drawing 11 explained, it is also possible to use the height data which detected the noise component on the amendment occasion. In this case, it is also possible to remove the noise in discontinuity, such as the binding section of a manuscript. Specifically based on the height data of a manuscript, the binding section of a manuscript, the highest point, and an edge are detected. What is necessary is just to remove as a noise the data which are contrary in these directions in the field where brightness changes by dividing into three without an increase, reduction, and change based on this data.

[0046] Furthermore, the example mentioned above explained three conditions for changing concentration control of the 1st method, and concentration control of the 2nd method. In the 1st example, the 2nd example showed [condition / kind / of manuscript / (are they a book manuscript or a sheet-like manuscript?)] / the thing on condition of the existence of a noise as the 3rd example the condition / the kind (are they a character picture or a halftone picture?) of picture /. It cannot be overemphasized that you may change on condition that various, and may make it change with the combination of these conditions in addition to these.

[0047]
[Effect of the Invention] Since concentration control of the 1st method based on the natural complexion concentration of a manuscript is performed when judged with a manuscript being a character picture, and concentration control of the 2nd method based on the height information on a manuscript is performed according to invention of a claim 1 as mentioned above when judged with it being a halftone picture, picture reappearance by the always optimal concentration is attained. Moreover, since concentration control of the 1st method based on the natural complexion concentration of a manuscript is performed when it is distinguished according to invention of a claim 2 that a manuscript is a sheet-like manuscript, and 2nd concentration control based on the height information on a manuscript is performed when judged with it being a book manuscript, picture reappearance by the always optimal concentration is attained. Moreover, detecting [of brightness data] becomes unnecessary in the case of a book manuscript, in the case of a sheet-like manuscript, detection of height becomes unnecessary and improvement in the speed of processing can be attained. Moreover, since 2nd concentration control based on the height information on a manuscript is performed when concentration control of the 1st method based on the natural complexion concentration of a manuscript is performed when the noise contained in the natural complexion concentration of a manuscript and the data of manuscript height information is in tolerance according to invention of a claim 3, and the noise of the natural complexion concentration of a manuscript exceeds tolerance, picture reappearance by the optimal concentration which is not influenced of a noise is attained.

[Translation done.]

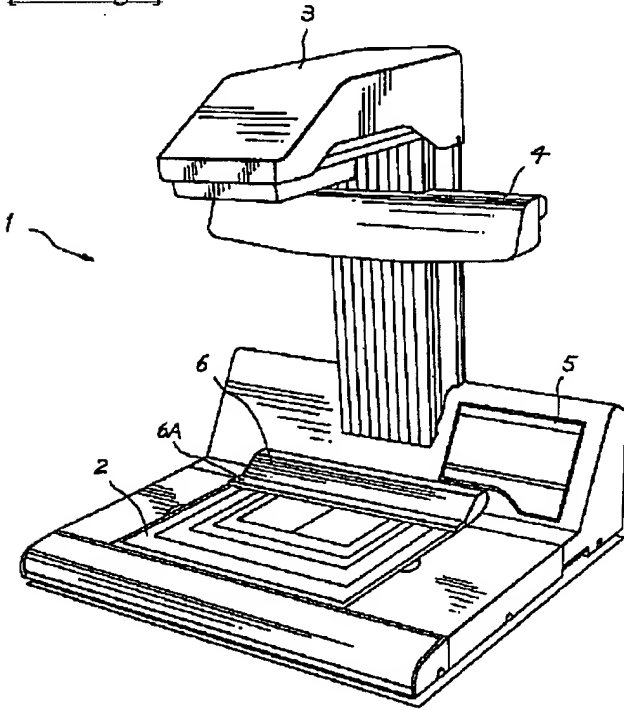
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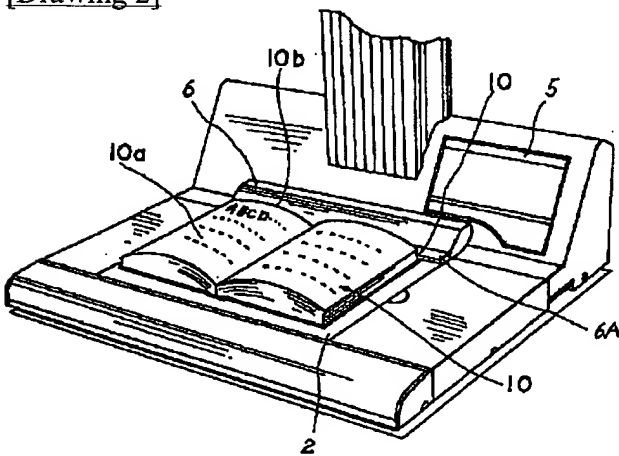
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

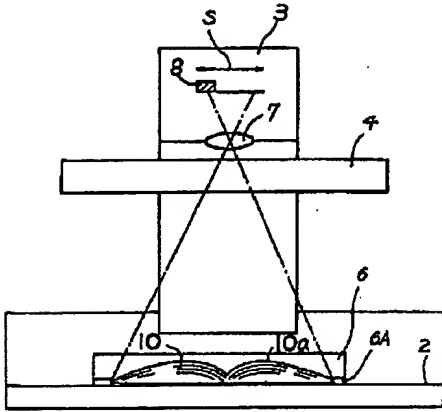
[Drawing 1]



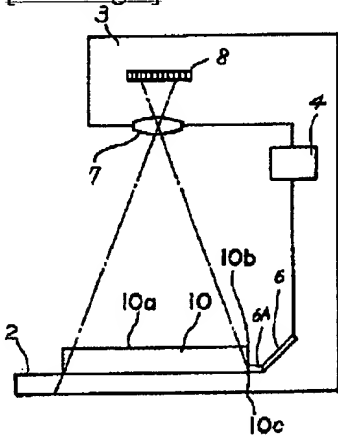
[Drawing 2]



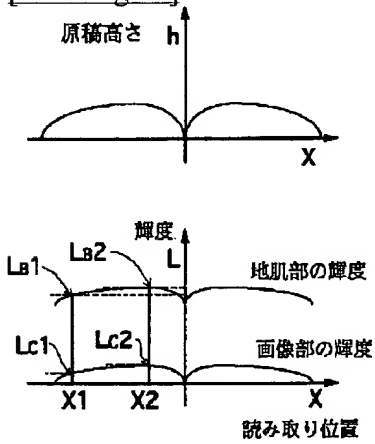
[Drawing 3]



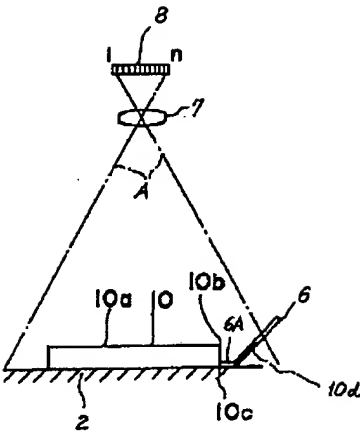
[Drawing 4]



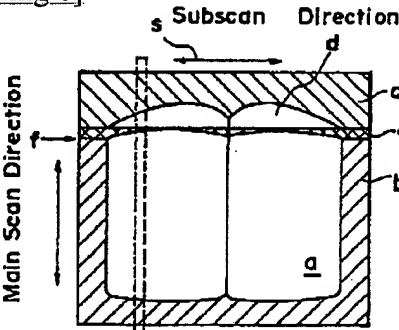
[Drawing 11]



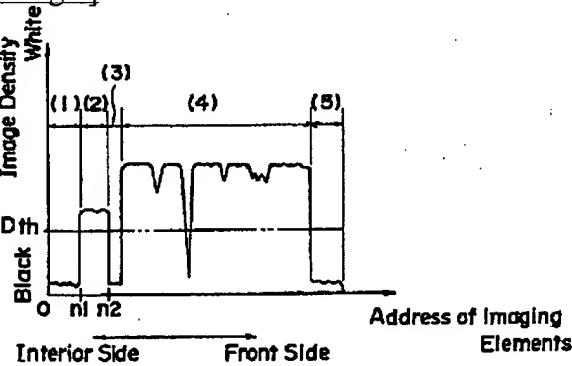
[Drawing 5]



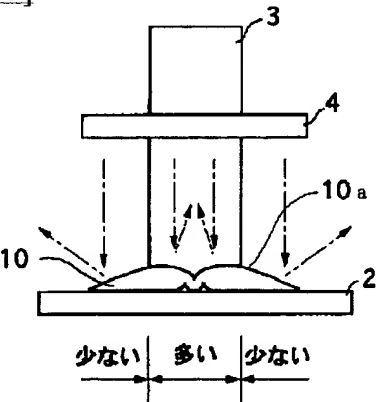
[Drawing 6]



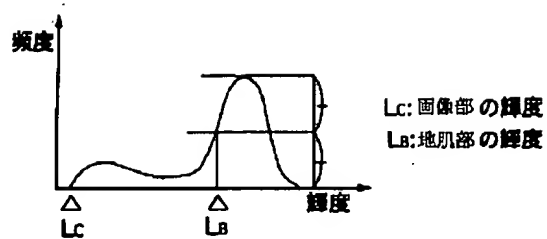
[Drawing 7]



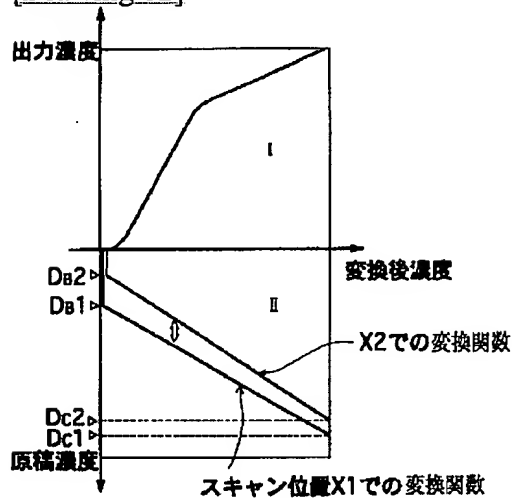
[Drawing 9]



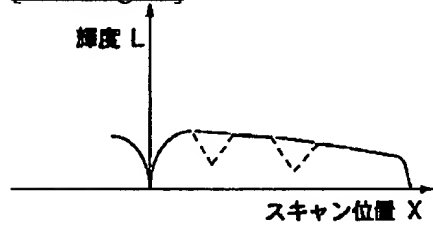
[Drawing 10]



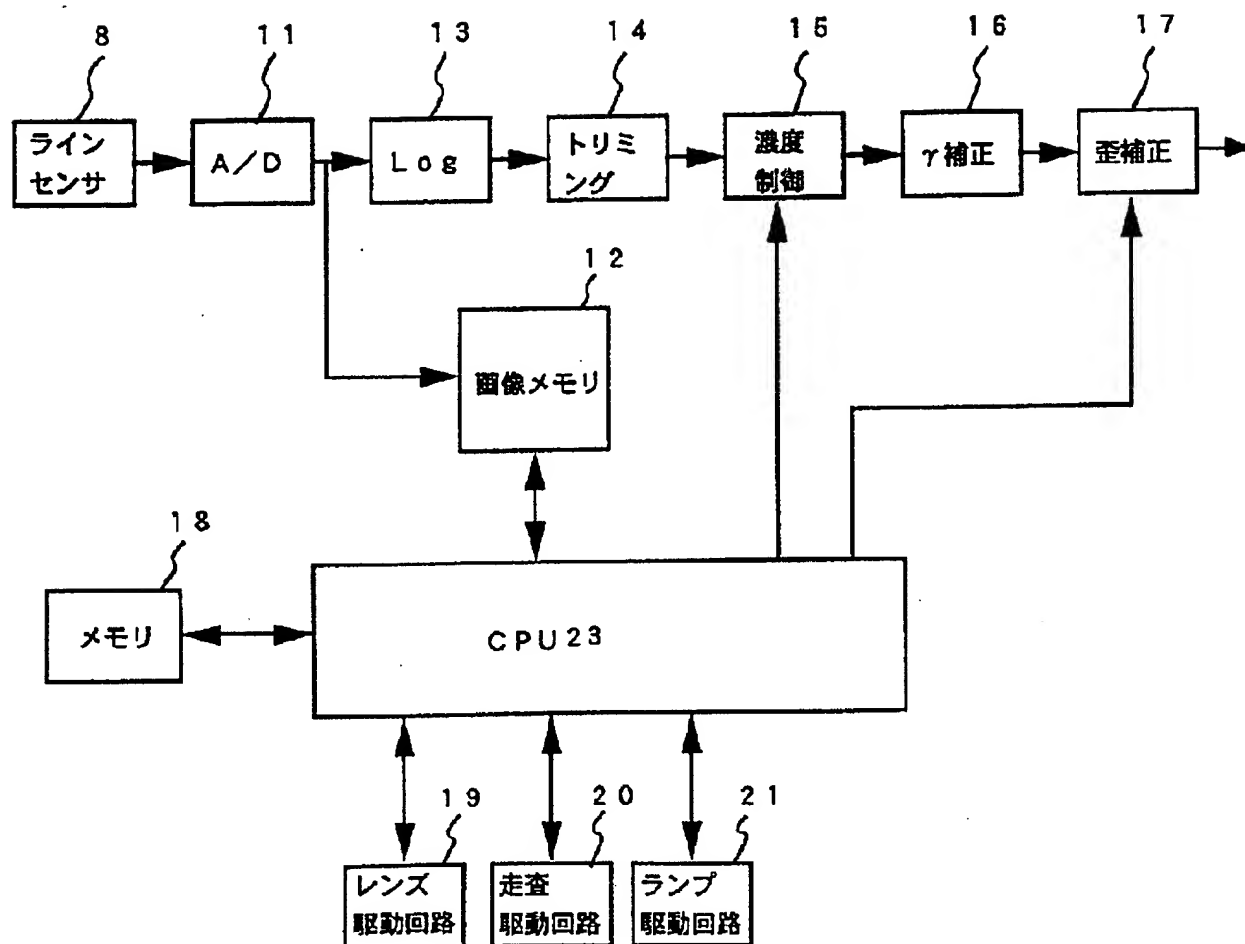
[Drawing 12]



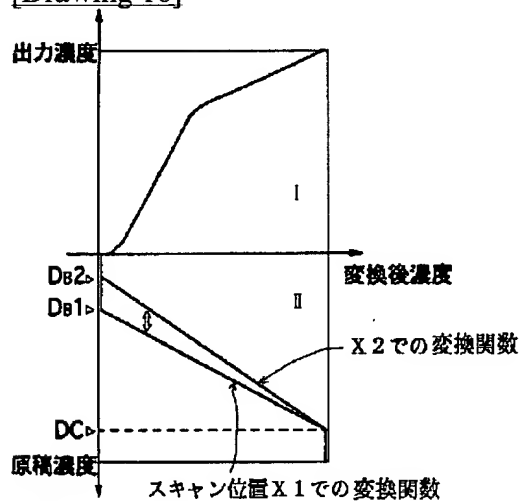
[Drawing 17]



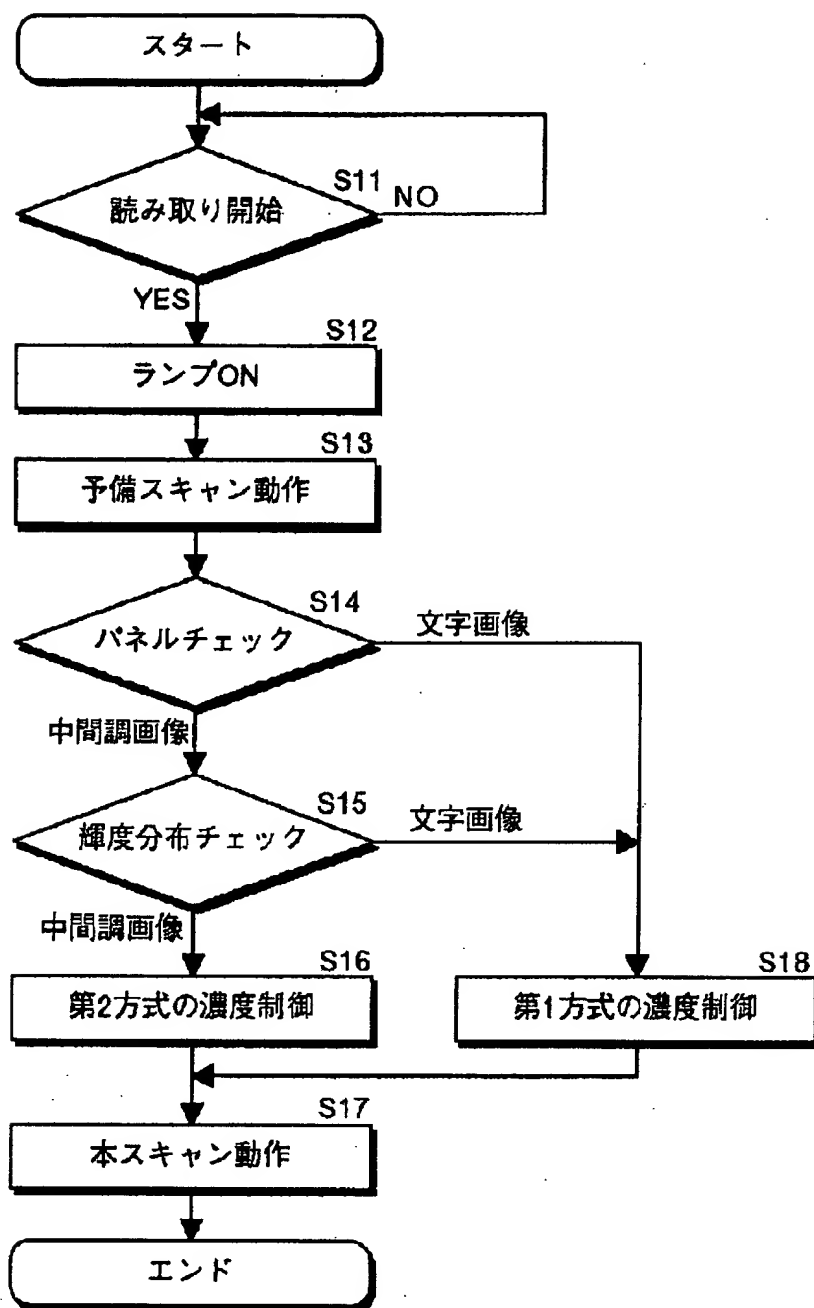
[Drawing 8]



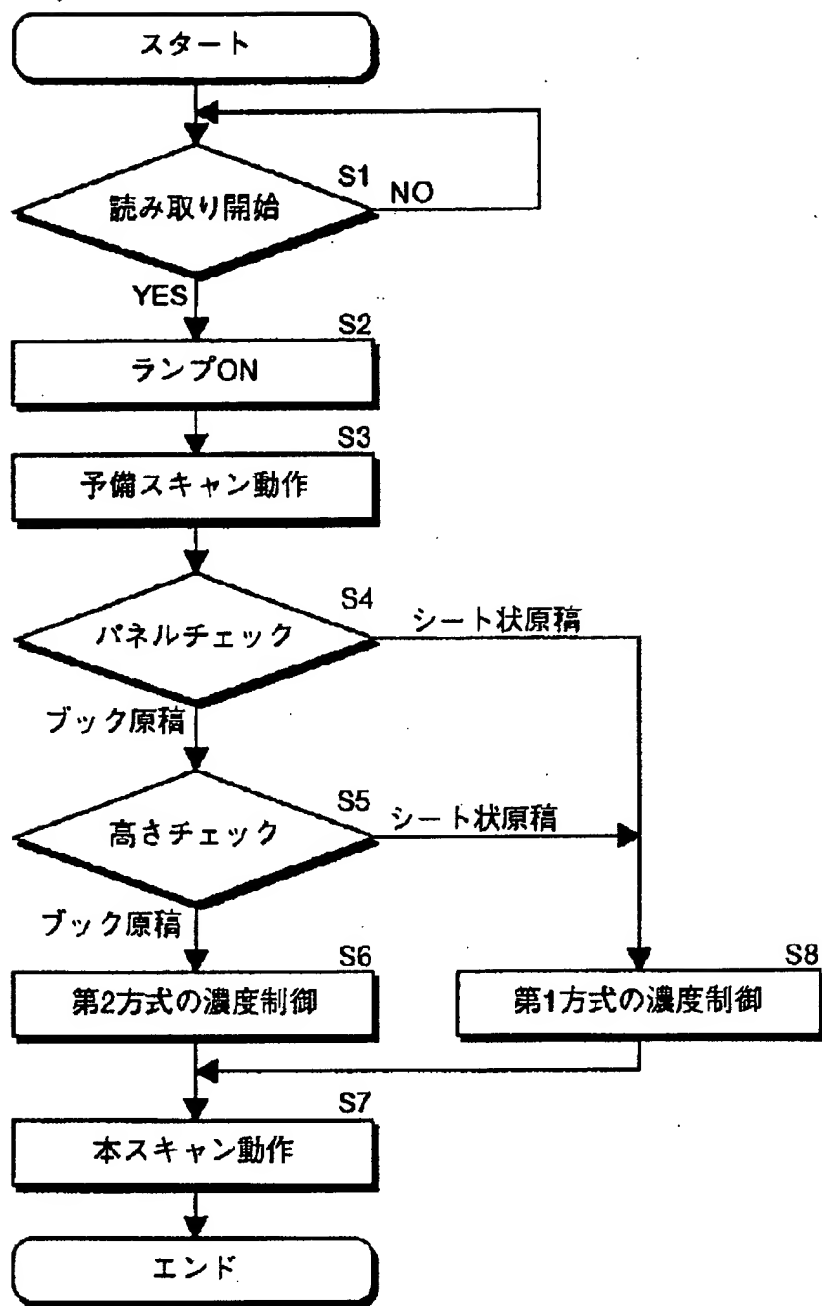
[Drawing 16]



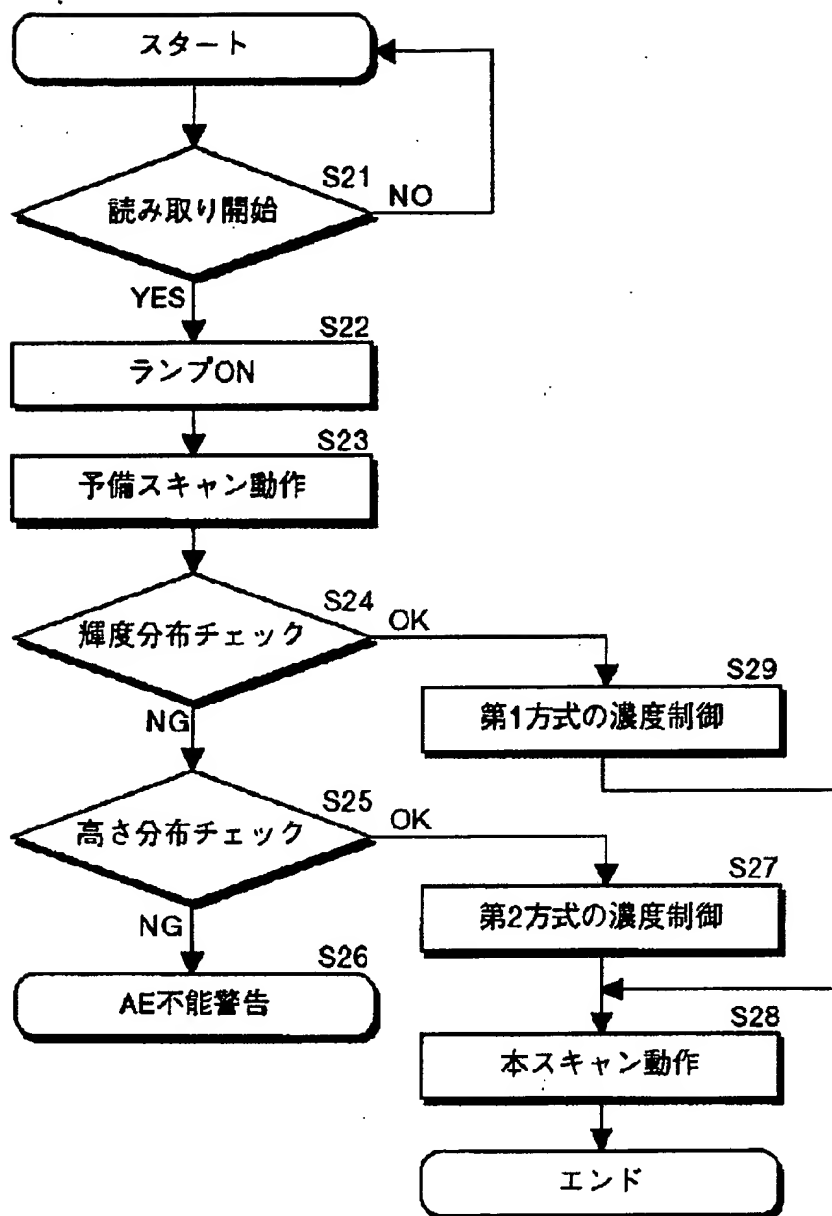
[Drawing 13]



[Drawing 14]



[Drawing 15]



[Translation done.]